

TITLE OF THE INVENTION

CAMERA DEVICE AND METHOD AND PROGRAM FOR STARTING THE  
CAMERA DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

5           This application is based upon and claims the  
benefit of priority from prior Japanese Patent  
Application No. 2003-048062, filed February 25, 2003,  
the entire contents of which are incorporated herein by  
reference.

10                           BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a camera device  
having a movable optical system, and a method and a  
program for starting the camera device.

15                           2. Description of the Related Art

Conventionally, in electronic still cameras or  
digital cameras, an object is picked up by an image  
pickup element such as a CCD or the like, and while the  
image is being displayed as a through image on a liquid  
20 crystal display device, the picked-up image is recorded  
as digital data on a recording medium such as a memory  
card or the like in accordance with an operation of a  
shutter. Accordingly, at the time of startup when the  
power supply of an electronic still camera is turned on  
25 for photographing, various initializing operations with  
respect to both of the hardware and the software, for  
example, such as a preparation for making data to be

able to be recorded on a recording medium, a preparation for image picking-up an object, and a preparation for displaying the picked-up image, are indispensable. As a time from the power-on until when it is in a state in which photographing is available, a given starting time which is longer than that in the case of a silver salt camera or an analog camera is required. Therefore, there is the shortcoming that the electronic still cameras or the digital cameras cannot cope with an urgent chance to press a shutter key.

Therefore, in order to make shortening of the above-described starting time to be possible, a conventional example in which a time of reading management information from an freely attachable and detachable memory card is omitted is disclosed in paragraph 0025 of Japanese Patent Application KOKAI Publication No. 2002-237977.

However, in an electronic still camera, which has a movable or sinkable optical system in which a lens is housed in a camera housing during non-photographing and it is necessary to protrude the zoom lens prior to photographing, the time required for protruding the optical system accounts for most of the starting time. Therefore, even if the time of reading management information from a memory card is omitted as in the conventional document, the time accounts for extremely small percentage of the total starting time, and there

is the problem that an effect on reduction in starting time has not been satisfactory yet.

#### BRIEF SUMMARY OF THE INVENTION

The present invention has been achieved in  
5 consideration of the conventional problem, and an  
object of the present invention is to provide a camera  
device which can reduce the starting time in an  
electronic still camera having a movable optical  
system, a method for starting the camera device, and  
10 a program used for realizing those.

According to an embodiment of the present  
invention, a camera device comprises an optical system,  
a driving unit which drives the optical system, and a  
control unit which makes the driving unit start driving  
15 of the optical system to a predetermined state by an  
initialization of the optical system, before other  
initializations than the initialization of the optical  
system, when the camera device is started up in a state  
in which an operation mode for photographing is set.

20 Additional objects and advantages of the present  
invention will be set forth in the description which  
follows, and in part will be obvious from the  
description, or may be learned by practice of the  
present invention.

25 The objects and advantages of the present  
invention may be realized and obtained by means of the  
instrumentalities and combinations particularly pointed

out hereinafter.

#### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the present invention and, together with the general description given above and the detailed description of the embodiments given below, serve to explain the principles of the present invention in which:

10           FIG. 1 is a block diagram schematically illustrating an electronic still camera showing an embodiment of the present invention;

            FIG. 2 is a schematic diagram showing a data storing structure of a flash memory in the electronic still camera of the embodiment;

15           FIG. 3 is a schematic diagram showing stored data at a program area of the flash memory;

            FIG. 4 is a former part of a flowchart showing a processing procedure of a CPU at the time of startup of the electronic still camera of the embodiment;

20           FIG. 5 is a latter part of the flowchart showing the processing procedure of the CPU at the time of startup of the electronic still camera;

            FIG. 6 is a schematic diagram showing relationships between types of startup interrupts and operational items realized by the respective interrupts; and

25

FIG. 7 is a flowchart showing a zoom-open processing of the embodiment.

#### DETAILED DESCRIPTION OF THE INVENTION

An embodiment of a camera device according to the present invention will now be described with reference to the accompanying drawings. FIG. 1 is a block diagram illustrating an electrical configuration of an electronic still camera showing the embodiment of the present invention.

The electronic still camera has a zooming function and an automatic focusing function, and has a lens block 1 for realizing the functions. The lens block 1 comprises a movable lens group 11 including a zoom lens and a focus lens which are movably arranged in the direction of an optical axis, position detecting sensors 12, 13 for a zoom position and a focus position in the lens group 11, a zoom motor 14 for moving the zoom lens and a focus motor 15 for moving the focus lens, an actuator 16 for an iris which opens and closes an iris (not shown), and an actuator 17 for a shutter which opens and closes a mechanical shutter. The above-described respective motors and actuators 14 to 17 are driven by various drivers 18 to 21, for zooming, for focusing, for an iris, and for a shutter, which are provided at a driver block 2. The respective motors 14, 15 and actuators 14 to 17, and the driver block 2 configure driving means.

The electronic still camera has a CCD image-pickup system block 3 including mainly a CCD 31 which is an image pickup element arranged at the rear side of the photographing optical axis of the lens group 11, a CDS (Correlated Double Sampling)/AD conversion block 32, and a TG (Timing Generator) 33. When the electronic still camera is set to a recording mode for photographing, the CCD 31 photoelectric-converts an optical image of an object which is formed by the lens group 11, and outputs, each given cycle, one photoelectric-converted output screen by being scanning-driven by the TG 33. The CDS/AD block 32 carries out noise elimination due to correlated double sampling and conversion into a digital signal with respect to an output analog signal whose gain has been appropriately adjusted for each of the color components of RGB by an amplifier (not shown) after being output from the CCD 31, and outputs the signal as an image pickup signal to a color process circuit 4.

The color process circuit 4 performs color process processing including pixel interpolation processing to the input image pickup signal, generates digital-valued luminance signal (Y) and color-difference signals (Cb, Cr), and outputs the signals to a CPU 5 serving as control unit for controlling the entire electronic still camera. The CPU 5 comprises a microprocessor having an internal memory, various arithmetic

processing circuits, an I/O interface for data, and the like.

The digital signal (image signal) transmitted to the CPU 5 is temporarily stored in a DRAM 6 and  
5 transmitted to an image display unit 7. The image display unit 7 includes a video encoder, a VRAM, a liquid crystal monitor, and a driving circuit thereof, and generates a video signal based on the transmitted video signal by the video encoder, and a  
10 display image based on the video signal, i.e., a through image of the object picked up by the CCD 31 is displayed on the liquid crystal monitor.

A key input unit 8 comprises various keys such as a power key, a recording/playback mode change-over  
15 switch, a shutter key, a menu key, or the like, and a sub-CPU which receives input therefrom and transmits an operation signal corresponding thereto to the CPU 5. The sub-CPU transmits a state signal showing a state of the mode change-over switch, i.e., a mode setting state  
20 as needed. When the shutter key is pressed down in the aforementioned recording mode, a trigger signal (operation signal) is output from the key input unit 8 to the CPU 5.

When the trigger signal is input, the CPU 5 reads  
25 out, for each of the components of Y, Cb, Cr and in basic units called basic blocks which are 8 pixels (vertical)  $\times$  8 pixels (horizontal), the image data of

one screen fetched from the CCD 31 at that point in time, and writes the image data into a JPEG circuit 9. The JPEG circuit 9 carries out DCT (Discrete Cosine Transform) and coding. The compressed one-image data  
5 compressed by the JPEG circuit 9 is stored in an image recording unit 42. The image recording unit 42 comprises a card interface, and nonvolatile various memory cards which are connected to the CPU 5 via the card interface, and which are mounted so as to be  
10 freely attachable and detachable on a camera body.

In the recording mode for photographing, the CPU 5 makes a lens control block 43 generate driving signals to be transmitted to the various drivers 18 to 21 of the driver block 2 on the basis of various programs  
15 stored in a rewritable nonvolatile flash memory 41, the aforementioned operation signal from the key input unit 8, or the like, and controls the position controls of the zoom lens and focus lens, an opening of the iris, and the opening and closing action of the  
20 mechanical shutter. Positional information of the lens detected by the position detecting sensors 12, 13 for a zoom position and a focus position are successively input to the CPU 5 via the lens control block 43.

On the other hand, the image data recorded in the  
25 image recording unit 42 is read by the CPU 5 in the playback mode for displaying the recorded image, transmitted to the image display unit 7 after being



expanded by the JPEG circuit 9, and displayed on the liquid crystal monitor.

FIG. 2 is a schematic diagram showing a data storing structure of the aforementioned flash memory 41. The flash memory 41 is storage means, and a lens information area 41a, a program area 41b, and memory area 41c for various data are ensured therein. At the lens information area 41a, device information which is the data acquired at the stage of factory shipping of the electronic still camera, and which shows the device performance of the lens group 11 (the zoom lens and the focus lens), and which is the adjustment data which is indispensable for controlling those, is stored. Moreover, at the lens information area 41a, device information of the image pickup system of the CCD 31, white balance characteristic, or the like, as well, are stored.

At the program area 41b, programs required for the control the aforementioned respective portions by the CPU 5, and various data required for the control are stored. In the present embodiment, as one example, as shown in FIG. 3, at the head portion of the program area 41b, an OS (Operating System) 101 which is indispensable for the operation of the CPU 5 and a startup program 102 comprising a lens control module 102a for startup, a starting factor determining module 102b for startup, a device information access module

102c for startup, and a program load module 102d for  
startup, which will be described later and are required  
for startup processings, are stored in a sequential  
order, and continuously, a main program 103 formed  
5 from a plurality of task modules 103<sub>1</sub>, 103<sub>2</sub>, ... 103<sub>N</sub>  
(TASK 1, TASK 2, TASK 3, ... TASK N) which are required  
for realizing various operations in the electronic  
still camera are stored. In the present embodiment,  
the OS 101 and the startup program 102 are a program  
10 for startup, and the program for startup and the main  
program 103 correspond to a control program.

The memory area 41c is an area which is managed by  
a file system configured by the CPU 5 after the startup  
of the OS, and various data which are read from the  
15 CPU 5 as needed and which are other than the above-  
described data are stored thereat. At this area,  
arbitrary data including image data as well are stored  
as needed.

Next, operations according to the present  
20 embodiment of the electronic still camera comprising  
the above-described configuration will be described in  
accordance with FIGS. 4 to 7. Flowcharts of FIGS. 4  
and 5 show the concrete processing procedures of  
the CPU 5 at the time of startup accompanying  
25 an ON-operation of the power switch.

After the CPU 5 is started up accompanying  
power-on, the CPU 5 loads only the OS 101 and

the startup program 102 from the program area 41b of the flash memory 41 by bootstrap loader, and expands those in the internal memory (step SA1), and thereafter, the CPU 5 starts up the OS (step SA2).

- 5 The bootstrap loader is a small program which is read for loading the program, and is to be automatically accessed by the CPU 5 at the same time of the startup, and is stored in a predetermined address area (other than the memory area 41c) of the flash memory 41.
- 10 Thereafter, the CPU 5 processes root tasks from step SA3 up to step SA24 on the basis of the startup program 102.

- Setting of hardware such as an initialization of a port or the like is carried out (step SA3), and
- 15 setting of an optical system interrupt handler, i.e., setting of interrupt processing required for the control of the lens group 11 is carried out (step SA4). A state signal is received from the sub-CPU of the key input unit 8, and a determination of a starting factor
- 20 is carried out (step SA5). Here, it is determined whether the mode state which has been set is a recording mode for photographing or another mode other than the recording mode, such as a playback mode for displaying a recorded image or the like. The
- 25 difference between the recording mode and the playback mode is whether or not a lens is required to be protruded when the power is turned on. If the

operation mode is the recording mode, the lens is required to be protruded when the power is turned on. The power supply of the optical system such as the lens block 1, the driver block 2, and the lens control block 43 is controlled so as to be turned on (step SA6), and  
5 device information is loaded from the flash memory 41 (step SA7). It is determined whether high-speed startup is carried out or normal startup is carried out on the basis of the determined results of the starting  
10 factor acquired in step SA5 (step SA8). When the mode which has been set is the recording mode, it is determined as the high-speed startup, and when the mode is another mode other than it, it is determined as the normal startup.

15           When the starting factor is the normal startup, the processings of the following steps SA9 to SA14 are not carried out, loading of the main program 103 which is the remaining control program is immediately started (step SA15).

20           On the other hand, when the starting factor is the high-speed startup, a predetermined time (for example, 30 ms or less) until the time when a voltage of the optical system started to be supplied in step SA6 rises a steady-state voltage is waited for (step SA9), and  
25 an initialization of the hardware in the lens control block 43 is carried out (step SA10). The shutter actuator 17 is made to start shutter open of the

mechanical shutter (step SA11), a battery voltage is checked at this point in time, and it is determined whether or not the battery voltage exceeds a predetermined voltage (step SA12). Note that, some  
5 waiting-for processings are carried out during from the time when the shutter open of the mechanical shutter is started to the time of the check for the battery voltage. Here, when the voltage value is the predetermined value or less, and it is determined as  
10 "No Battery," the processings of the following steps SA13 and SA14 are not carried out, loading of the main program 103 which is the remaining control program is immediately started (step SA15).

On the other hand, when the voltage value exceeds  
15 the predetermined value, and it is determined as "Battery OK," a check and an initialization of the adjustment data for the zoom lens and the focus lens among the device information loaded in step SA7 are carried out (step SA13), and the protrusion (zoom-open)  
20 of the zoom lens for an initialization of the lens group 11 is made to start (step SA14).

Here, the zoom-open processing of the zoom lens will be described. The processing is carried out by the interrupt for startup which is prepared in the lens  
25 control module for startup of the startup program 102. FIG. 6 is a schematic diagram showing the relationship between types of the interrupts for startup and

operational items realized by the respective interrupts, and the zoom-open processing is achieved by ADC, MOTOR (ZOOM), edge (pulse), and timer interrupts. The ADC interrupt carries out analog-to-digital  
5 conversion with respect to the detected value from a photo interrupter (or photoelectric sensor, not shown) provided at the camera body, and outputs the value. The MOTOR (ZOOM) interrupt controls an output of the zoom motor 14. The edge (pulse) interrupt  
10 detects a moving amount of the zoom lens by counting of the number of pulses. Timer interrupt performs a time count and a timing adjustment and realizes a shutter-open processing.

FIG. 7 is a flowchart showing the zoom-open  
15 processing (step SA14 of FIG. 4). A zoom correction value, i.e., a moving amount up to a target position to which the zoom lens is protruded is calculated on the basis of the device information (step SB1). Confirmation of housing of the lens group 11 is carried  
20 out (step SB2). The confirmation is carried out by confirming whether a detected level (PR output) due to the ADC interrupt is "H" or "L."

Thereafter, driving of the zoom lens by the MOTOR (ZOOM) interrupt and the timer interrupt are started  
25 (step SB3).

At the beginning, the confirmation of detecting of the PR output is continued, and it is determined

whether the zoom lens is released from the state of being housed or not (steps SB4, SB5). When the zoom lens is released from the state of being housed (YES in step SB4), after a moving amount of the zoom lens is once reset (step SB6), moving pulses (edge pulses) are counted one by one (step SB7). When the zoom lens reaches the target position (e.g., a Wide end) in a short time (YES in step SB8), driving of the zoom lens is stopped (step SB9), the processing OK is set and reported to the outside (step SB10), and the driving processing is completed. Note that, on the way of the processing, when the state of the zoom lens being housed cannot be confirmed (NO in step SB2), when it cannot be confirmed that the zoom lens is released from the state of being housed, and when the moving pulses cannot be counted, the driving of the zoom lens is stopped due to error processing, processing NG is set and reported to the outside (steps SB11 to SB14), and the driving processing is completed.

Immediately after the above-described zoom-open processing (step SA14) of the zoom lens is started, the CPU 5 starts loading of the remaining program (step SA15). Namely, without the end of the zoom-open operation of the lens group 11 being waited for, the main program 103 is loaded simultaneously.

Continuously, an initialization of the hardware, i.e., a memory card of the image recording unit 42,

a message buffer, the DRAM 6 or the like (steps SA16, SA17), checking of the remaining data of the device information (other than the adjustment data of the zoom lens and the focus lens), and an initialization of the  
5 CCD image pickup system block 3 by using those data (step SA18), and initializations of an LED and the display system (steps SA19, SA20) are carried out. Moreover, initializations of the software, i.e., initialization of the sub-CPU (various settings) and  
10 an initialization of a memory manager are carried out (steps SA21, SA22). Some of initializations of the sub-CPU are already carried out at the time of the determination of a starting factor in step SA5. After the respective tasks realizing various operations in  
15 the main program 103 which completed loading are generated (step SA23), the termination processing of the root task is carried out (step SA24). After these processings, the memory area 41c becomes a usable state.

20 Hereafter, the routine proceeds to execution of processings corresponding to the respective modes for recording and playback in the same way as in the normal processing based on the processings of the plurality of tasks generated (step SA25). Namely, the CPU 5  
25 executes various initializing processings such as an initialization of the iris, initializations of the image pickup system of the CCD 31, white balance



characteristic, or the like, an initialization of focus control, a preparation for displaying of a through image on the image display unit 7, or the like.

As described above, in the present embodiment,  
5 when a recording mode is set when the device is started up by power-on, initializing operation (steps SA9 to SA14) in which the lens group 11 is zoomed open is immediately started, and during the time, operations required for the other initializations are  
10 simultaneously carried out. Accordingly, a starting time required for photographing in the configuration having movable lens 11 can be markedly reduced, and speedup of the starting time is possible. Instead of initializing the optical system after all the programs  
15 are loaded, a minimum number of programs required to initialize the optical system are first loaded and the initialization of the optical system is prioritized. Thus, the time from the power is turned on until the lens is protruded is shortened. These minimum number  
20 of programs are performed by an interrupt processing not by the normal task so that a task preparation time is not needed.

Further, in the present embodiment, because the startup program 102 and the main program 103 are  
25 divided and loaded, and a zoom-open operation of the lens group 11 is carried out on the basis of the startup program 102, the zoom-open operation of

the lens group 11 can be started in an early stage. Speedup of the starting time is possible thereby as well.

Moreover, because, without the end of the zoom-  
5 open operation of the lens group 11 started being  
waited for, the main program 103 is read simultaneously  
with the zoom-open operation of the lens group 11,  
an operating time required for the initializing  
operations other than the zoom-open operation of  
10 the lens group 11 can be shortened. Speedup of  
the starting time is possible thereby as well.

Note that, differently from the present  
embodiment, it may be configured such that the startup  
program 102 and the main program 103 are collectively  
15 loaded, or such that some of the startup program 102  
and the main program 103 are loaded. In this case as  
well, in the same way as in the present embodiment, by  
simultaneously carrying out the operations required for  
other initializations except for the zoom-open  
20 operation of the lens group 11 during the time when the  
zoom-open operation of the lens group 11 is being  
carried out, speedup of the starting time is possible.

Further, as in the present embodiment, even if the  
device is a type in which the flash memory 41 cannot  
25 carry out random-access, due to the OS 101, the startup  
program 102, and the main program 103 being serially  
stored in the flash memory 41, the startup program 102

can be efficiently divided and loaded. Accordingly, efficiency of the processing at the time of startup can be improved, and speedup of the starting time is possible thereby as well.

5           In accordance with the embodiment of the present invention, in a camera device having a movable optical system, driving means for driving the optical system, and control unit for making the driving means start driving to a predetermined position by  
10           an initialization of the optical system, before the other initializations than the initialization of the optical system, at the time of startup in a state in which an operation mode for photographing is set, are provided.

15           Therefore, at the time of startup in a state in which an operation mode for photographing is set, a mechanical initializing operation which is such that the optical system is driven (zoomed open) to a predetermined position, and operations required for the  
20           other initializations can be simultaneously carried out.

          Moreover, storage means for storing a control program required for the control of the camera device is further provided, and the control unit reads a  
25           program for startup which is required for the initialization of the optical system included in the control program from the storage means. After the

driving means is made to start driving of the optical system by an execution of the startup program, the control unit reads a control program except for the program for startup, from the storage means.

5           Therefore, because the program for startup which is required for the initialization of the optical system is read separately from the programs required for the initializations other than the initialization of the optical system, the initialization of the  
10           optical system at the time of startup can be started in an early stage.

          The control unit reads the control program except for the program for startup from the storage means without waiting for the end of the driving to the  
15           predetermined position by the initialization of the optical system.

          Therefore, by reading the programs required for the initializations except for the initialization of the optical system on the way of the initialization of  
20           the optical system, an operating time required for the initializing operations other than that of the optical system can be shortened.

          Further, the other control programs are stored continuously after the program for startup in the  
25           storage means.

          Therefore, even in a configuration in which the storage means for storing the control program cannot

carry out random-access, the control program can be efficiently divided and read.

Furthermore, in accordance with another embodiment of the present invention, a method for starting the camera device having a movable optical system comprises  
5 a step of determining whether an operating mode for photographing is set or not, and a step of making the driving means start driving to a predetermined position by an initialization, before other initializations than  
10 the initialization of the optical system, when the operating mode for photographing is set.

Therefore, at the time of startup in a state in which the operation mode for photographing is set, during the time when a mechanical initializing  
15 operation which is such that the optical system is driven (zoomed open) to a predetermined position is being carried out, and the other initializing operations required for the other initializations can be simultaneously carried out.

20 In addition, in accordance with yet another embodiment of the present invention, a program for a computer controlling a camera device having a movable optical system and driving means for driving the optical system makes the computer as control unit for  
25 making the driving means start driving to a predetermined position by an initialization of the optical system, before the other initializations than

the initialization of the optical system, at the time of startup in a state in which the operating mode for photographing is set.

Therefore, at the time of startup in a state in  
5 which the operation mode for photographing is set,  
during the time when a mechanical initializing  
operation which is such that the optical system is  
driven (zoomed open) to a predetermined position is  
being carried out, and the other initializing  
10 operations can be simultaneously carried out.

While the description above refers to particular  
embodiments of the present invention, it will be  
understood that many modifications may be made without  
departing from the spirit thereof. The accompanying  
15 claims are intended to cover such modifications as  
would fall within the true scope and spirit of the  
present invention. The presently disclosed embodiments  
are therefore to be considered in all respects as  
illustrative and not restrictive, the scope of the  
20 invention being indicated by the appended claims,  
rather than the foregoing description, and all changes  
that come within the meaning and range of equivalency  
of the claims are therefore intended to be embraced  
therein. For example, the present invention can be  
25 practiced as a computer readable recording medium in  
which a program for allowing the computer to function  
as predetermined means, allowing the computer to

realize a predetermined function, or allowing the computer to conduct predetermined means.